

Doc. No. WW-8

United States Patent Application

Title: LIQUID CANNON HAVING TRUNNION ASSEMBLY

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## I FIELD OF INVENTION

This invention relates to a Water Cannon<sup>n</sup> for directing a stream of liquid at a selected direction and inclination for a selected duration, and to a unique trunnion for varying the direction and inclination of a water or other type cannon.

## II BACKGROUND OF THE INVENTION

U.S. Patents 5,160,086 and 5,641,120 disclose methods and apparatus for forming a lighted laminar flow fluid stream.

However, neither of these references disclose means for varying the direction, inclination or duration of the fluid stream.

U.S. Patents 1,526,342; 2,759,731; 3,342,492; 3,362,713 disclose water pistols and cannons used as amusement devices. But these references do not involve trunnion support.

U.S. Patent 4,905,900 discloses a method and apparatus for cleaning an air conditioner with a water cannon having an air gun therein for explosively discharging a quantity of water to dislodge sludge in the air conditioner. But it is not supported on a trunnion.

U.S. Patent 4,058,256 discloses a water cannon mounted on a vehicle such as an armored car with a trunnion for controlling crowds of unruly people. But this device is not at all for amusement, and does not disclose the trunnion

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stops to prevent undue horizontal and vertical azimuth bearing of the cannon.

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U.S. Patent 4,338,852 discloses a trunnion having stops to control vertical <sup>azimuth</sup> ~~azimuth~~ bearing of a gun and a torsion bumper stop for absorbing shock loads as the gun nears the limits of its upward and downward motion. <sup>B</sup> ~~But~~ this <sup>is</sup> ~~not~~ a water cannon or an amusement device.

### III SUMMARY OF THE INVENTION

#### A. OBJECTS OF THE INVENTION

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One object of the present invention is to provide a trunnion for varying the direction and inclination of <sup>AN</sup> ~~A~~ apparatus for launching a fluid or solid.

Another object of the present invention is to provide a method and apparatus for launching a fluid stream at a selected direction and inclination.

Another object of the present invention is to provide a method and apparatus for varying the duration of the fluid stream.

Another object is to provide a water cannon amusement device.

Another object is to provide means for varying the extent of horizontal variation permitted.

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Another object is to provide resilient stop means for varying the ~~the~~ horizontal inclination of the device.

Another object is to provide means for varying the extent of vertical variation permitted.

Another object is to provide resilient stop means for varying the ~~the~~ vertical inclination of the device.

Other objects will be apparent <sup>from</sup> the following Description and Drawings.

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B. SUMMARY

In accordance with the present invention a trunnion assembly is provided for mounting a launching device including a horizontal locating assembly 10 to provide for selected horizontal movement of the the launching device and a vertical locating assembly 80 for varying the inclination of the launching device.

In one embodiment the launching device includes an accumulator tank 24 located below the locating assemblies 10, 80, which receives a liquid such as water. A valve assembly 30 including solenoid valve 32 is in fluid communication with the accumulator <sup>tank</sup> 24. Valve assembly 30 may be electrically or ~~pneumatically~~ <sup>pneumatically</sup> controlled <sup>by</sup> a controller 34.

A ~~station~~ <sup>station</sup> assembly 40 includes a curved stand 42 having a vertical portion 43, a curved portion <sup>45</sup> and a horizontal portion <sup>46</sup>. Vertical portion 43 includes a ~~a~~ lower end <sup>portion</sup> 44 which extends into a bearing assembly 50 including a cylindrical enclosure 51 which receives cylindrical bearing 52 made of known composite bearing material, and is connected to ~~stand end~~ <sup>lower</sup> portion 44 with removable fastening means 53 such as bolt 54. Bearing 52 is movable with respect to enclosure 51 and mounting plate 55 to which is integrally connected as by welding.

A flexible conduit means 60 includes a first fluid containing conduit 61. A second flexible electrical conduit 62 carrying wires 63, and first conduit 61 are fed into

stand <sup>lower</sup> end portion 44 and through stand <sup>40</sup> 42 and extend through stand horizontal portion 45 and into a barrel assembly <sup>70</sup> including a cylindrical barrel 71 <sup>and</sup> through cylindrical barrel extension 72.

Pattern openings 14 <sup>(Figures 2-20)</sup> are provided in <sup>mounting</sup> base plate 55 to receive stop assemblies 20 including stop plates 21 having openings 22 to receive fasteners 23. Stops 24 are mounted vertically on stop plates 21. Resilient bumpers 25 made of elastomeric material having a Durometer value of about 60 to 100 A Scale are mounted on stops 24 with fasteners 26 which extend through respective openings 27 and 28, 28a in stops 24 and part way through bumpers 25. As shown in Figures <sup>2E and 2F</sup> 2E and 2F, the fastener 29 may be formed <sup>integral</sup> integral with the bumpers, or the opening 28a may be threaded to receive threaded fastener 26 <sup>(Figure 2D)</sup>. Thus the extent of horizontal rotation can be varied through varied placement of stop assemblies 20 into openings 14.

The <sup>vertical locating</sup> inclination stop assembly 80 fits within stand horizontal portion <sup>46</sup> 45 and barrel extension 72, and as shown in Figures 3-6 includes a cylindrical casing 81 extending into <sup>horizontal</sup> stand portion <sup>46</sup> 45 having elongated openings 81a to receive set screws 87. The extent of the elongation of openings 81a allows limited adjustability of the extent of vertical travel of the barrel 71. Located within casing 81 is a sleeve 82 having openings 82a to also receive set <sup>screws</sup> screws 87, which fix the location of sleeve 82. A pair <sup>of</sup> of cylindrical dogs 83 and 85 each having cutaway portions

83b and 85b are located within casing 81 and are movable on shaft 86a extending from base 86, having a head 86b located within barrel extension 72 and includes openings 86c to receive set screws 87 which render the shaft 86a movable with barrel 71 about the horizontal A-A in Figure 1.

Located within respective cutaway portion 83b and 85b are semi-cylindrical floating stops 84 and 84S made of elastomeric <sup>resilient</sup> ~~resilient~~ material such as polyurethane having a Durometer value of 60 to 100 A Scale. As shown <sup>in</sup> ~~in~~ Figure 5 clearance 84C exists between floating stop 84 and dog 85. Similar clearance exists between floating stop 84 and dog 83.

<sup>The</sup> ~~This~~ Flexible conduit 62 containing wires 63 extends through barrel 71 to a <sup>barrel</sup> ~~first~~ end 73 to a light assembly 90 to light the liquid <sup>carried</sup> ~~carried~~ through flexible conduit 61 and discharged from the second end of the barrel <sup>75</sup> ~~1~~, which houses an orifice assembly 100. The light assembly 90 includes <sup>an</sup> ~~and~~ electrical switch 91, a light bulb 92, and an activating <sup>button</sup> ~~bottom~~ 93 held in place within barrel end ~~portion~~ 73 by end cap 74. At the <sup>second</sup> ~~other~~ end <sup>75</sup> ~~1~~, an orifice assembly 100 includes an orifice 105 which may have a knife edge 106. Optionally diffuser material 107 may be included to lower the Reynolds number of the liquid to create laminar flow.

#### IV THE DRAWINGS

a Figure 1 is a schematic <sup>perspective</sup> view of the trunnion and water cannon apparatus of the present invention.

a Figure 2 is a bottom ~~perspective~~ view of the horizontal location assembly of the present invention.

Figure 2A is a bottom view of the horizontal location assembly and the mounting plate of the present invention.

Figure 2B is a perspective view of the horizontal location assembly of the present invention.

Figure 2C is a perspective view of the horizontal location bumper of the present invention.

Figure 2D is a view looking in the direction of the arrows along the line 2D-2D in Figure 2C.

Figure 2E is a perspective view of another embodiment of the horizontal location bumper of the present invention.

Figure 2F is a view looking in the direction of the arrows ~~2D-2D~~ along the line 2F-2F in Figure 2E.

Figure 2G is a perspective view of the vertical location assembly of the present invention.

Figure 3 is a top plan view of the vertical location assembly of the present invention.

Figure 4 is an elevation view of the vertical location assembly of the present invention.

Figure 5 is a schematic perspective view of the vertical location assembly of the present invention.

Figure 6 is an exploded view of the vertical location stop assembly of the present invention.



## V DESCRIPTION OF PREFERRED EMBODIMENTS

In accordance with the present invention a trunnion is provided for mounting a <sup>first</sup> launching device including a horizontal <sup>locating</sup> stop assembly 10 to provide for selected horizontal movement of the the launching device and <sup>a second</sup> an <sup>vertical locating</sup> ~~inclination~~ stop assembly 80 for varying the inclination of the launching device.

In one embodiment the launching device includes an accumulator tank 24 located below the first and second stop assemblies which receives a liquid such as water through an adapter 25 to allow for various size supply hoses.

A valve assembly 30 including, for example, a solenoid valve 32 is in fluid communication with the accumulator 24. Valve assembly 30 may be electrically or pneumatically controlled by a controller 34. A second on and off valve 33 is provided which may be manually operated. Valve 32 is provided to control air pressure in the tank which may be electrically or <sup>pneumatically</sup> ~~pneumatically~~ controlled <sup>by controller 34</sup>.

A <sup>stanchion</sup> ~~station~~ assembly 40 includes a curved stand 42 having a vertical portion 43, a <sup>generally</sup> curved portion <sup>45</sup> ~~44~~ and a horizontal portion <sup>46</sup> ~~45~~. Vertical portion 43 includes a lower end 44 which extends into a bearing assembly 50 including a cylindrical enclosure 51 which receives cylindrical bearing 52 made of known composite bearing material, and is connected to stand end portion 44 with removable fastening means 53 such as bolt 54. Bearing 52 is

movable with respect to enclosure 51 and mounting plate 55 to which is integrally connected as by welding.

End portion 44 extends below mounting plate 55. The first stop assembly 10 is mounted on the bottom of base plate 55, and a cylindrical stop ring 11, having an extension stop 12 integrally connected thereto as by welding, is mounted on portion 44 with removable fasteners 13.

Pattern openings 14 are provided in base plate 55 to receive stop assemblies 20 including stop plates 21 having openings 22 to receive fasteners 23. Stops 24<sup>a</sup> are mounted vertically on stop plates 21. Resilient bumpers 25<sup>a</sup> made of elastomeric material having a Durometer value of about 60 to 100 A. Scale are mounted on stops 24 with fasteners 26 which extend through respective openings 27 and 28, 28a in stops 24<sup>a</sup> and part way through bumpers 25<sup>a</sup>. As shown in Figures<sup>2E and 2F</sup> the fastener 29 may be formed <sup>integral</sup> with the bumpers, or the opening 28a may be threaded to receive threaded fastener 26<sup>a</sup>. (Figures 2C and 2D) Thus the extent of horizontal rotation can be varied through varied placement of stop assemblies 20 into openings 14 in base <sup>mounting</sup> plate 55.

Valve assembly 30 includes a pipe fitting 31 to which is connected a flexible conduit means 60 including a first fluid containing conduit 61. A second flexible electrical conduit 62 carrying wires 63 and first conduit 61 are fed into <sup>stand</sup> ~~stancion~~ end portion 44, <sup>46</sup> and through stand 42, <sup>70</sup> and extend through stand horizontal portion 45 and into a barrel assembly <sup>70</sup> including a cylindrical barrel 71 through

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D cylindrical barrel extension 72, integrally connected to barrel 72<sup>71</sup> for example by welding.

E Flexible conduit 62 containing wires 63 extends through barrel 71 to a first end 73 to a light assembly 90 to light the liquid <sup>carried</sup> ~~carried~~ through flexible conduit 61 and discharged from the second end 75 of the barrel, which houses an orifice assembly 100.

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E The light assembly 90 includes and electrical switch 91 connected to wires 63, a light bulb 92, and an activating button 93 <sup>bottom</sup> held in place within barrel end portion 73 by end cap 74, <sup>in turn</sup> held in place with removable fasteners 96. At the other end <sup>the</sup> ~~the~~ orifice assembly 100 includes a pipe fitting 101 which engages conduit 61, which is held in place with a front cover 102 with removable fastening means 103. A trim piece 104 holds in place an orifice 105 which may have a knife edge 106. Optionally diffuser material 107 may be included to lower the Reynolds number of the liquid to create laminar flow.

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r The barrel includes means 110 <sup>(Figure 2B)</sup> for moving the launching device both vertically and horizontally, for example handles 112.

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r The accumulator <sup>24</sup> ~~10~~ is in fluid communication with the second end 75 of the barrel through conduit 61. Water or other liquid is supplied to the accumulator 24 through the hose 26 and adapter 25.

a The first valve means 30 is in fluid communication with the accumulator 24, which is electrically or pneumatically

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controlled by ~~by~~ controller 34 acting through wires 63 in conduit 62 extending to button 93 in light assembly 90. The light assembly 90 for activating liquid discharge is located adjacent handles <sup>112</sup>~~28~~. The duration of the time required to refill accumulator 24 may be controlled with controller 34 with an electrical connection to a supply pump 27 having graduated pump speeds to vary the accumulator refill time.

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The <sup>vertical locating</sup>~~inclination stop~~ assembly 80 fits within stand horizontal portion <sup>46</sup>~~45~~ and barrel extension 72, ~~and as shown~~ in Figures 3-6 includes a cylindrical casing 81 extending into horizontal ~~stand~~ <sup>46</sup>portion having elongated <sup>openings</sup>~~opening~~ therein 81a to receive set screws 87. The extent of the elongation of openings 81a allows limited adjustability of the extent of vertical travel of the barrel 71. Located within casing 81 is a sleeve 82 having openings 82a to also receive set <sup>screws</sup>~~screws~~ 87, which fix the location of sleeve 82. A pair cylindrical dogs 83 and 85 each having cutaway portions 83b and 85b are located within casing 81 and are movable on shaft 86a extending from base 86, having a head 86b located within barrel extension 72 and includes openings 86c to receive set screws 87 which render the shaft 86a movable with barrel 71 about the horizontal A-A in Figure 1.

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Located within respective cutaway portion 83b and 85b are semi-cylindrical floating stops 84 and 84S made of elastomeric <sup>resilient</sup>~~resilient~~ material such as polyurethane having a Durometer of 60 to 100 A Scale. As shown in Fig. 5 clearance

a 84C exists between floating stop 84 and dog 85. <sup>5</sup> Similar clearance exists between floating stop 84 and dog 83. This clearance allows rotation by handles 112 of barrel 71 to the extent of the clearance between resilient stop 84 and dog 83 in one direction, and in the other direction, between resilient stop 84s and dog 85. Limited variation in the extent of this clearance can be achieved by <sup>Varying</sup> ~~varying~~ the location of set screws 87 in elongated slots 81a.

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D In operation, on and <sup>off</sup> ~~or~~ valve 33 is first moved to the open position. Controller 34 is activated to fill accumulator tank 24 with liquid through hose 26 and <sup>adapter</sup> ~~adater~~ 25. Air in the accumulator is compressed as the liquid enters ~~the~~ accumulator. A customer inserts a coin into the coin receiver <sup>(not shown)</sup> ~~114~~, which activates the the electrical and/or <sup>pneumatic</sup> ~~pneumatic~~ circuits for operation. The customer selects a target horizontally by using handles 112 to rotate stand portion 44 <sup>between</sup> stop assemblies 20. The customer selects <sup>a</sup> ~~are~~ vertical orientation by using handles 112 to rotate barrel 71 about axis A-A to the extent of clearance between resilient floating stops 84 and 84s relative to dogs 84 and 85. The customer then presses button 93 to activate solenoid valve 35 through wires 63 and controller 34. This causes fluid to flow from accumulator 34 through conduit 61 through stand 42, and then through barrel 71, through pipe filling 101 into orifice assembly 100 and out orifice 105. Under the control of controller 34, the liquid automatically is <sup>refilled</sup> ~~refilled~~ into accumulator 24. The light bulb 92 signals when

the cycle has run and the customer may make another liquid blast.

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a The extent of horizontal rotation can be varied by moving stop assemblies to selected <sup>pattern</sup>~~pattern~~ openings 114. The extent of vertical rotation can be varied by <sup>Varying</sup>~~varying~~ the location of set screws 78 in elongated openings <sup>slotted</sup>~~81a~~.

E The horizontal locating assembly 10 and the vertical locating assembly 80 of the barrel may be used to launch a crowd control liquid such as described in U.S. Patent <sup>058</sup>~~4,085~~,256; or a solid such as bullets or mortars, such as described in U.S. Patent 4,338,852. Each of these patents is hereby incorporated into the present application by this reference.

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